# NANORACKS

## Rapid, Reliable, Flexible and Affordable Access to the International Space Station and LEO

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## Categories of Services

- External Platform: For sensors, technology, and materials testing
- Small Satellite Launches: Currently focused on cubesats, but up to 180 kg possible
- Internal: 4 internal platforms, including plate reader, two microscopes, and centrifuge
- Return to Earth: Using either Soyuz or Dragon
- Data Return: Near real-time
- High security processes

**We started with internal pressurized services, and have been investing private capital to expand our offerings**

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# First Cubesats Launched from ISS

## October 4, 2012 — Middle cubesat is Nanoracks customer

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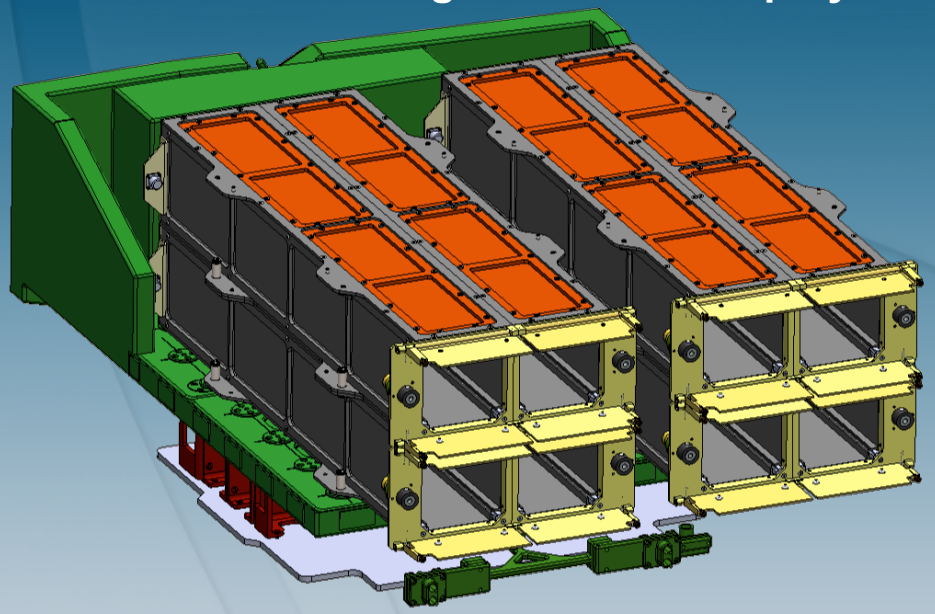
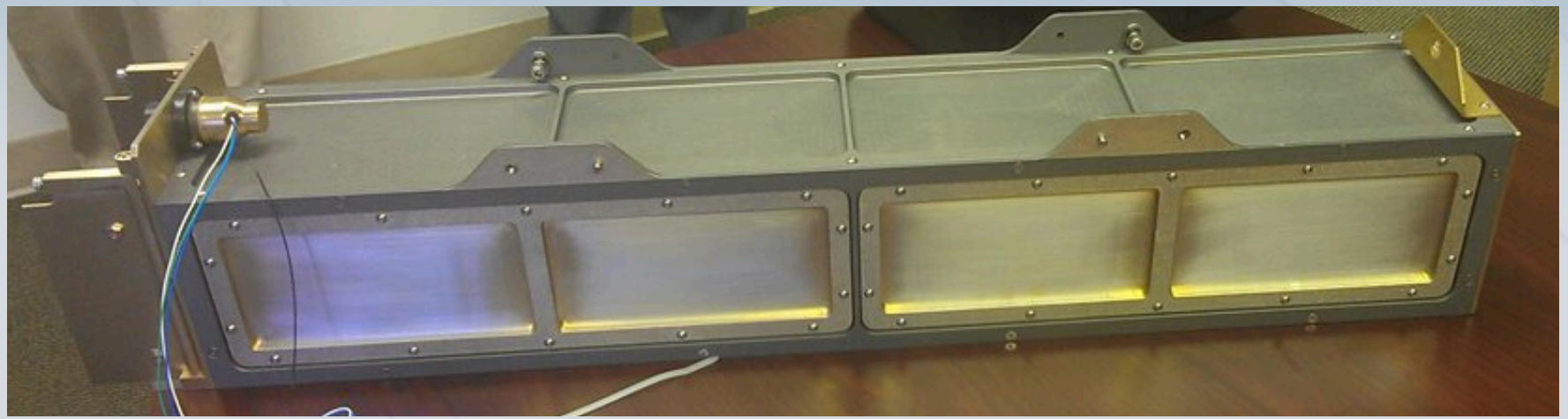
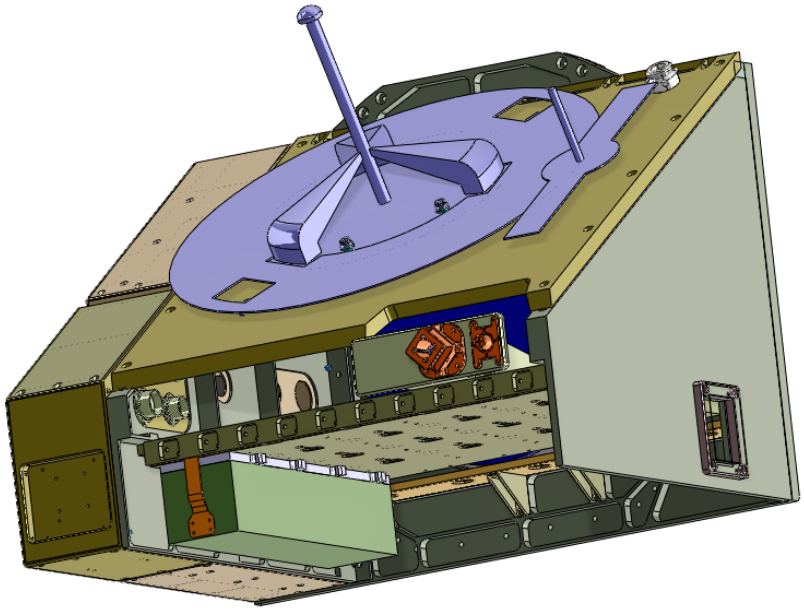
# NanoRacks CubeSat Deployer System

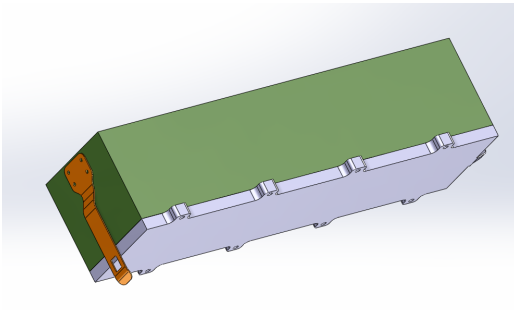
## Eight stackable deployers loaded into JEM airlock





## External Platform Program





## EPP Service Details

**Payload size can be up to 4U (10 by 10 by 40 cm) in the Cubesat form factor or**

**Utilization of the full volume at 580 x 570 x 260 mm**

**Services Provided Include:**

- **NASA interface**
- **Launch Manifesting**
- **NASA Safety Review**
- **Payload integration**
- **Launch to the ISS**
- **Astronaut Services**
- **Power if Required**
- **Data Flow if Required**
- **Exposure for a time period based on customer and manifest**
- **Possible return of Payload**

**Additional Services such as Payload Development are possible.**

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## Initial customers

Federal Agencies

Basic and Applied Researchers

Universities

Israeli, German, Saudi and other international

All Commercial Contracts

## Deliveries to Date

109 payloads to ISS

12 payloads returned to Earth

100% success thru NASA safety

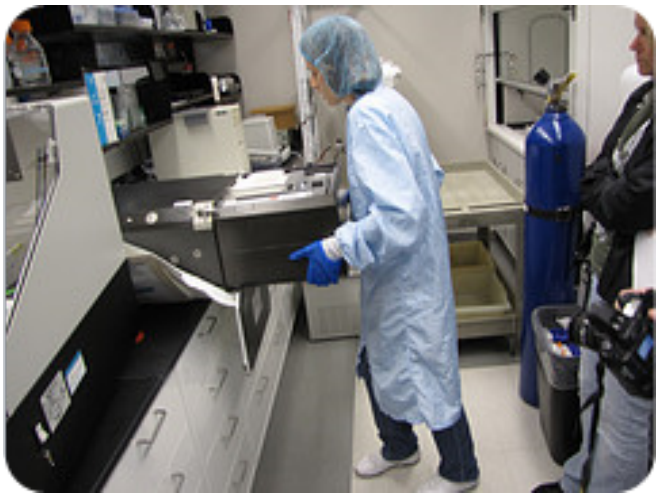
## Pipeline (Under Contract)

70 internal payloads

>60 smallsat payloads

- 100 more under MOU

2 External Platform payloads



Late Load of Biological Payloads—Cancer, Stem Cell on from Florida lab.

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## Our Service Value

- Low-cost
- Rapid: Average time from contract signing to delivery to ISS is 9 months
- Frequent: 8-12 flights/year
- Reliable: Multiple redundant and highly reliable LVs
- Flexible: Miss a flight? Next flight is in 1-3 months
- Easy Ride: Benign vibro-acoustic environment to LEO
- Secure: ISS high security processes available
- Easy Contracting: Existing IDIQ contract with NASA

We manage the end-to-end service, so you don't have to. Our customers can focus their energy and time on their payloads.

# NANORACKS

Operates with NASA via Space Act Agreement.

Self-funded the first hardware. Investors for later rounds.

NASA as landlord, safety regulator and customer for services.

**Today we are the first company that owns, operates and commercially markets its own hardware on the International Space Station.**

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## Access to Space Station

We manifest on all vehicles going to and from the space station:

- Dragon up and down
- Cygnus
- ATV
- Progress
- Soyuz up and down
- HTV

## Our Business Model

By employing commercial practices we provide faster passage through the NASA system, utilizing fully the extraordinary capabilities of the U.S. National Lab and the overall low-earth orbit space infrastructure.

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## Our NASA SAA Allows NR:

- To directly access NASA ISS manifest including ISS Partners
- To access NASA crew time
- To handle payload integration
  - independent of CASIS
- To work directly w/ any USG Agency
- To eliminate peer review and USG selection processes for access to manifest
- To privately own hardware on ISS
- To negotiate new agreements, such as recent agreement with USG and Japan to supply ISS cubesat dispensers from SpaceX-3 onwards for both govt & commercial

## How we Operate

NanoRacks operates principally under a Space Act Agreement (SAA), #6355

Signed by William Gerstenmaier, NASA Associate Administrator for Human Spaceflight, in September 2009

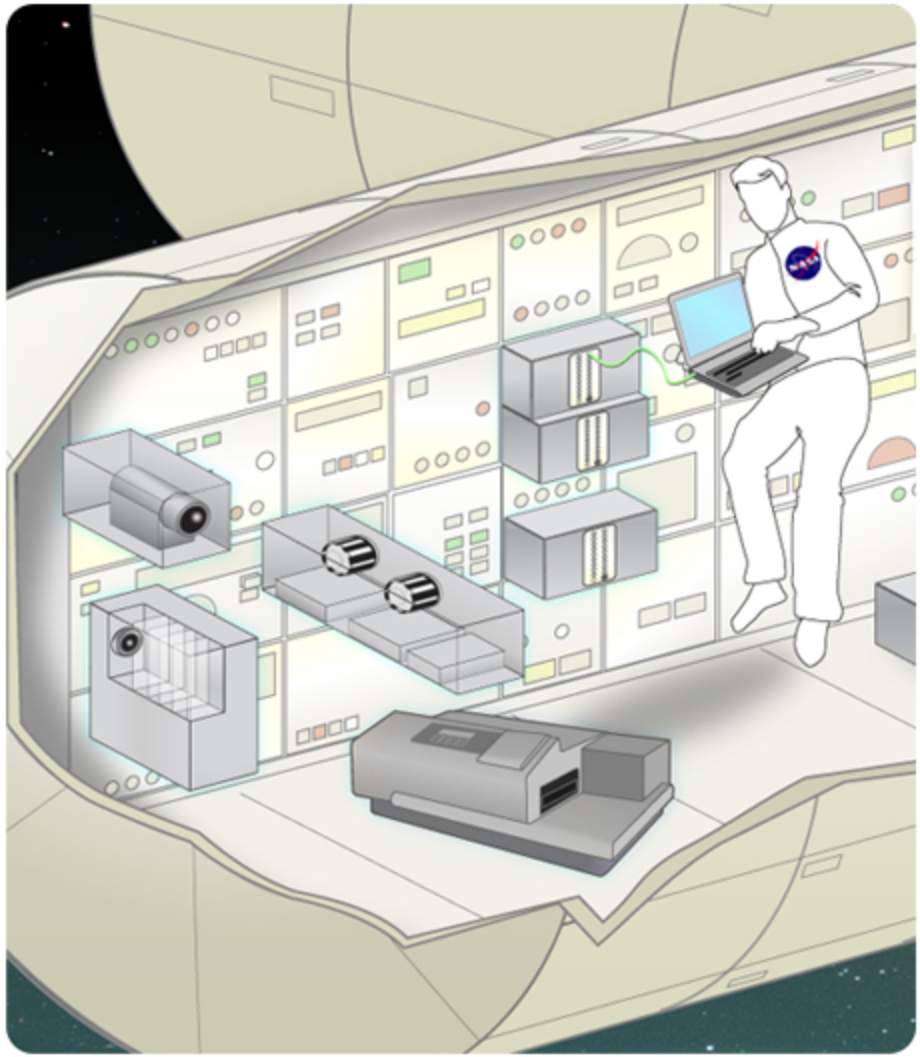
Enables streamlined commercial processes and procedures

## Easy Acquisition

- Nanoracks has an IDIQ contract w/ NASA JSC
- For all 3 Nanoracks services
- CONTACT: Mary Walsh, JSC
  mary.walsh-1@nasa.gov
  281-483-3331
- Process Summary
  - PI-sponsored Implementation Plan developed
  - Submit Task Order (TO)
  - Initiate funding transfer
  - JSC Procurement will issue TO

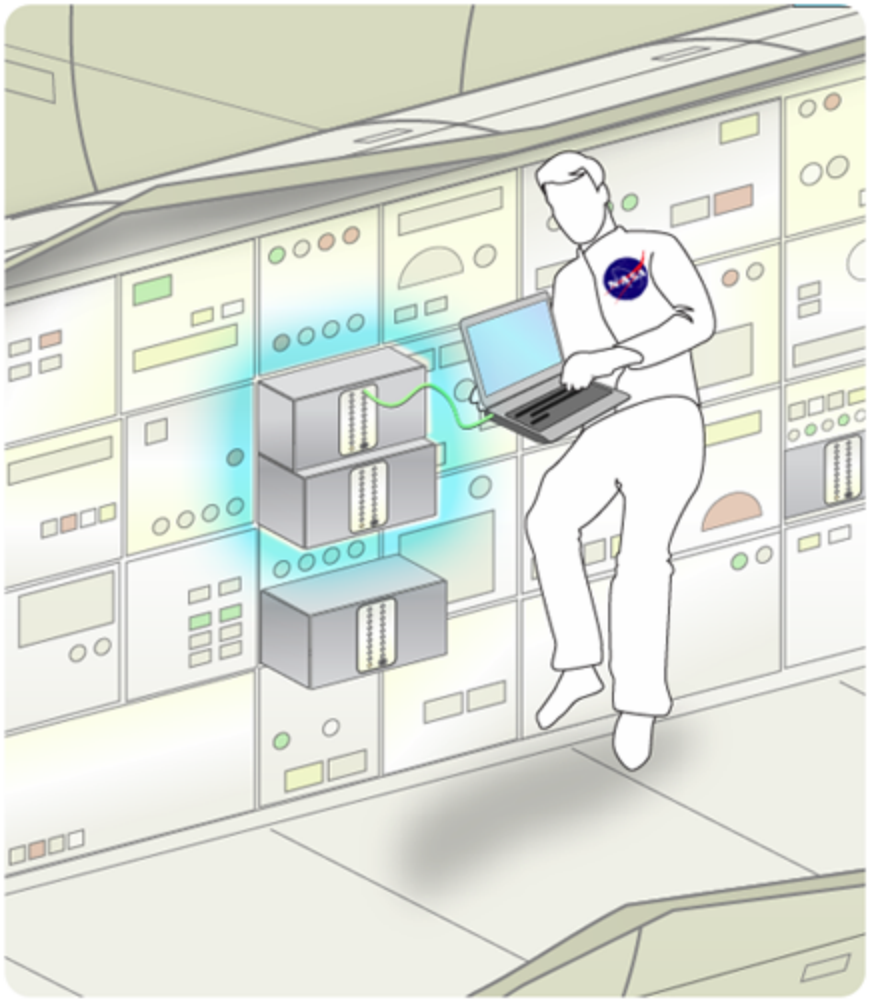
**We are working every day to manage the end-to-end service to make it easier on our customers. Our customers can focus their energy and time on their payloads.**

# NanoRacks Commercial Laboratory Inside International Space Station



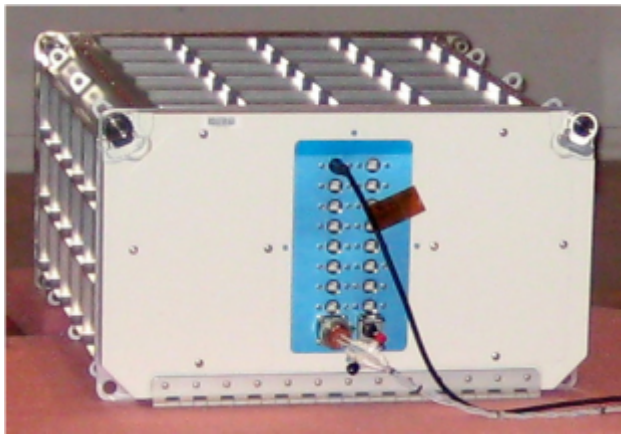
- Four research platforms in CubeSat form factor with USB standard interface
- Two microscopes (transmission and reflective);
- BioRack centrifuge (w/ Astrium)
- Plate reader (Molecular Devices M5e) for sophisticated on-orbit analysis (w/ Microplate and Cuvette spectrophotometers);
- Protein crystal growth system based on industry standards
- Hardware for biological research
- Data return to customer (via STELLA)
- Power available
- Return of payloads (optional)

## NanoRacks Platform-1 and NR-2



**Two research platforms developed and funded by NanoRacks in just six months;**

- **16 payload slots in the CubeSat form factor of 10 cm by 10 cm by 10 cm**
- **USB standard interface**
- **Allows the ultimate plug-and-play for for payloads**
- **Permanent addition to U.S. National Lab on Space Station**



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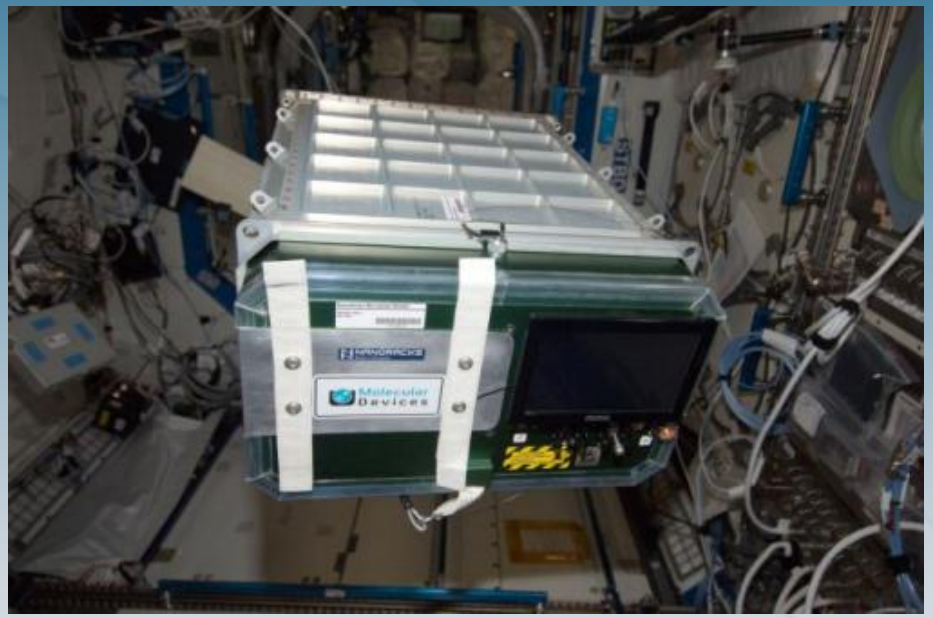
## NanoRacks Plate Reader

- Off-the-shelf Molecular Devices M5e
- Critically needed by researchers
  - Enables analytical experiments in biochemistry, stem cell and cancer research, immunology, and microbial growth, etc.
- Nanoracks provided money-back guarantee to NASA, if it did not work
- In return we own the unit, and are marketing it commercially
  - Two customers signed already
- Operational 3rd quarter of 2012



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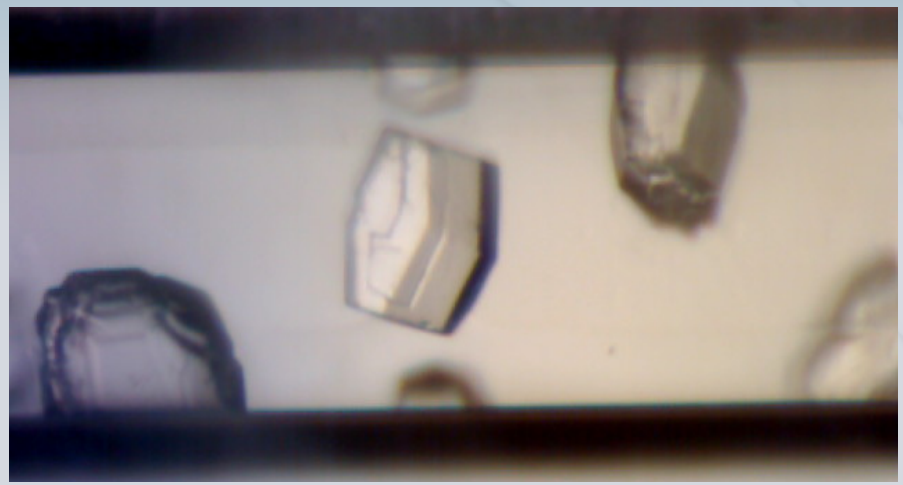
## Protein Crystal Growth System

### Nanoracks PCG System:

- Uses same hardware and procedures used in standard Earth lab PCG experiments
- Emerald Bio Crystal Cards (industry standard)
  - 400 variations per card
  - PI can vary protein, buffer, precipitate
  - 24 cards per Nanolab
  - Allows 24 proteins & 9,600 variations per trip
- Examined by astronaut in orbit
- Then returned to Earth

### PCG-1 Results (Summer 2013):

- 25 proteins grown for 60 days in microgravity in over 9,600 conditions
- More than 100 crystals grown
- Pre-publication paper available

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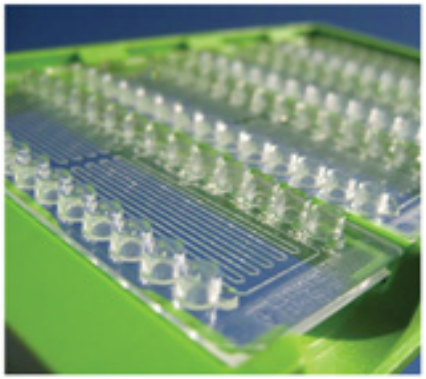
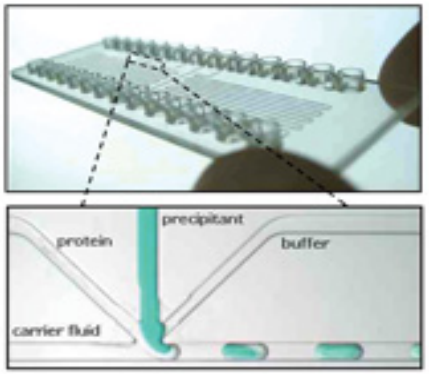
## Services and Procedures offered by PCG Program

- Consultation with our crystallographers & other industry experts
- Customer delivers Protein to designated location for Emerald Bio
- Proteins are prepared by Emerald Bio personnel with the reagents and buffers and then flash frozen
- Crystal cards delivered by NanoRacks to launch site; launched and then allowed to thaw and grow
- Astronaut will examine via microscope on orbit
- Crystals then returned to Earth and to customer

# NANORACKS



**1** Proteins loaded onto Emerald Bio CrystalCards™



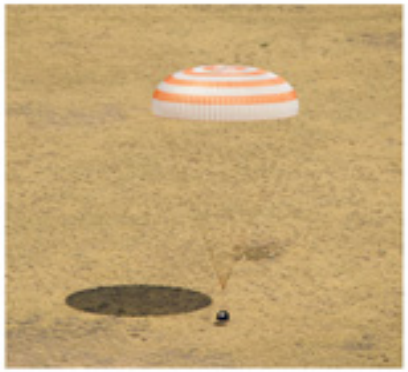

**2** Cards immediately flash frozen with LN2 (-196C)

**3** CrystalCards™ stored at -80C to -95C until arrival at ISS

**4** Once thawed, CrystalCards™ will be maintained at a temperature of 22-23 C

**5** Proteins examined during mission with pictures and videos sent to customer

**6** During return to earth CrystalCards™ will have active temperature control



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**PRICE: $12,000 (per crystal card)**

Each crystal card holds 1 protein with 400 conditions

The price for the PI is complete and includes:

- All NASA related activities, including manifesting on the launch vehicle, inclusion onto and use of the NanoRacks hardware, astronaut time, data return and sample return
- All on the ground preparation from preparing the Crystal Cards to integrating them for the mission

NanoRacks Educational Program has involved 39 school districts, dozens of schools without federal funding. We work with 5 educational organizations

NCESSE
Inspire ... Then Educate
National Center for Earth and Space Science Education

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**NASA Honors Communities Across the United States Engaged in SSEP Mission 1 to ISS with a Feature Article**

Published on May 11, 2012 by Jeff Goldstein in Program News

The National Aeronautics and Space Administration has honored all the SSEP researchers, their teachers, their families, and communities participating in the historic SSEP Mission 1 to ISS with a feature article at NASA.gov. It is a recognition that these student researchers are part of America's Space Program in the 21st century, and a tribute to this next generation that will take the human race to new frontiers.

The National Center for Earth and Space Science Education, and NanoRacks, would like to thank NASA for their unwavering support of SSEP, and the tens of thousands of students it touches.

Fitchburg, MA: Monty Tech student Brittany loading sam
at Woods Hole Oceanographic Institution

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Fact Sheet

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NanoRacks-Valley Christian High School Plant Seed Growth (NanoRacks-VCHS_Plant_Seed) 07.25.12

Overview | Description | Applications | Operations | Results | Publications | Images

Experiment/Payload Overview

Brief Summary

NanoRacks-Valley Christian High School Plant Seed Growth (NanoRacks-VCHS Plant Seed)is the project of Valley Christian High School in San Jose, California. The experiment contains an extended-sized autonomous, self-contained plant-seed growth experiment which is plugged into a NanoRacks Platform on board the International Space Station (ISS). The internal camera provides snapshots of the stages of growth during the experiment.

Principal Investigator

- Werner Vavken, , Valley Christian High School, San Jose, CA, United States

Co-Investigator(s)/Collaborator(s)

Information Pending

Payload Developer

NanoRacks, LLC, Houston, TX, United States